Reg. No. :

Question Paper Code: 31051

B.E/B. Tech. DEGREE EXAMINATION, NOV 2016

Fifth Semester

Computer Science and Engineering

01UMA521 – DISCRETE MATHEMATICS

(Common to Information Technology)

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. Construct a truth for *(7p <-> 7q) <-> (p <-> q).*

2. Define universal and existential quantifiers.

3. State Pigeonhole principle and its generalization.

4. In how many ways can integers 1 through 9 be permuted such that no odd integer will be in its natural position?

5. Define complete graph and regular graph.

6. Give an example of a graph which contains an Eulerian circuit that is also a Hamiltonian circuit.

7. Define semi groups and monoids, also give examples for each.

8. Let (*R*, +, .) ba a ring. For a, *bεR* show that *a.(-b)* = -*(a.b)*

9. Le $X = \{2, 3, 6, 12, 24, 36\}$ and the relation $\leq$ be such that $x \leq y$ if *x* divides *y*. Draw the Hasse diagram of $< X, \leq >$.

10. State the Isotonic property of a Lattice.

PART - B (5 x 16 = 80 Marks)

11. (a) (i) Show that $Q.V\ (P \wedge 7Q) \vee (7P \wedge 7Q)$ is a tautology. (8)

(ii) Obtain PDNF of $(P \wedge Q)\ V\ (7P \wedge R)\ V\ (Q \wedge R)$. Also find PCNF. (8)

Or

(b) (i) State $P \rightarrow (Q \rightarrow R) \Leftrightarrow P \rightarrow (7Q \vee R) \Leftrightarrow (P \wedge Q) \rightarrow R$ without constructing the truth table. (6)

(ii) Use CP rule to prove that $R \rightarrow S$ can be derived from the premises $P \rightarrow (Q \rightarrow S)$, $7R \vee P$ and Q. (10)

12. (a) (i) There are 250 students in an engineering college. Out of these 188 have taken a course in Fortran, 100 have taken a course in C and 35 have taken a course in Java. Further 88 have taken a course in both Fortran and C. 23 have taken course in both C and Java, and 29 have taken a course in both Fortran and Java. If 19 of these students have taken all these courses, how many of these 250 students have not taken a course in any of these three programming languages? (8)

(ii) Use the method of generating function to solve the recurrence relation $a_n = 4a_{n-1} - 4a_{n-2} + 4^n$; $n \geq 2$ given that $a_0 = 2$ and $a_1 = 8$. (8)

Or

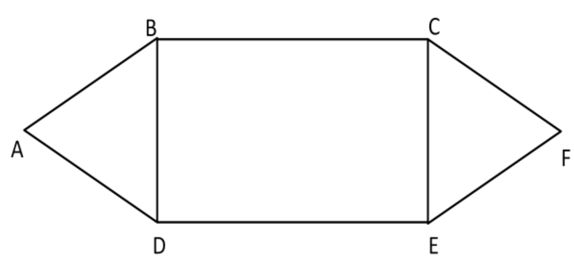
(b) (i) Solve the recurrence relation $a_n = 2a_{n-1} + 2^n$, $a_0 = 2$. (8)

(ii) Prove by mathematical induction, that

$$\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \dots\dots\dots + \frac{1}{n(n+1)} = \frac{n}{n+1}$$

(8)

13. (a) (i) Find all the simple paths from A to F and all the circuits in the graph. (8)



(ii) Prove that a simple graph with n vertices and k components can have at most $\frac{(n-k)(n-k+1)}{2}$ edges. (8)

Or

(b) (i) If all the vertices of an undirected graph are each of odd degree k, show that the number of edges of the graph is a multiple of K. (8)

(ii) Define a tree and hence prove that a tree with n vertices has $(n - 1)$ edges. (8)

14. (a) (i) State and prove Lagrange's theorem. (8)

(ii) Show that the intersection of two normal sub groups of a group G is also a normal subgroup of G. (8)

Or

(b) (i) If $\{G, *\}$ is an abelian group then show that $(a * b)^n = a^n * b^n$ for all $a, b, \in G$ where n is a positive integer. (8)

(ii) The necessary and sufficient condition for a nonempty subset H of a group $\{G, *\}$ to be a subgroup is $a, b \in H \Rightarrow a * b^{-1} \in H$. (8)

15. (a) (i) Show that the complement of every element in a Boolean algebra is unique. (8)

(ii) Consider the set of all divisors of 24, check does this form a POSET. Also draw the Hasse diagram of $(D_{24}, /)$. (8)

Or

(b) (i) In a distributive lattice $\{L, \vee, \wedge\}$ if an element $a \in L$ has a complement then it is unique. (8)

(ii) Find the distinctive normal forms of the Boolean expression $f(x, y, z) = xy + yz'$ by

(1) Truth table method

(2) Algebraic method (8)

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